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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 353)

JULY 25, 1997

01
AERONAUTICS

19970019674 Royal Air Force, Royal Air Force Repair Design Authority, Barry, UK
Royal Air Force Experience of Mechanically-Fastened Repairs to Composite Aircraft Structures
Chicken, S. H., Royal Air Force, UK; Jan. 1997; 8p; In English; Also announced as 19970019652; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The RAF has been repairing helicopter composite rotor blades, fiber-glass radomes and panels on a variety of combat aircraft types for many years. However, the Service's main experience in the maintenance of carbon fibre composite (CFC) material has been related to the Harrier 2 aircraft. This paper describes the main CFC structures of the Harrier 2 and outlines the variety of RAF peace-time, bolted structural repairs applied to the aircraft. Examples are provided of various simple and complex repairs. Author

Aircraft Maintenance; Aircraft Structures; Composite Structures; Composite Materials; Fighter Aircraft; Glass Fibers; Harrier Aircraft; Maintenance

19970019703 Logistics Management Inst., McLean, VA USA
ASAC Executive Assistant Architecture Description Summary ***Final Report***
Roberts, Eileen, Logistics Management Inst., USA; Villani, James A., Logistics Management Inst., USA; Apr. 1997; 212p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01
Report No.(s): NASA-CR-201681; NAS 1.26:201681; LMI-NS601T2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In this technical document, we describe the system architecture developed for the Aviation System Analysis Capability (ASAC) Executive Assistant (EA). We describe the genesis and role of the ASAC system, discuss the objectives of the ASAC system and provide an overview of components and models within the ASAC system, discuss our choice for an architecture methodology, the Domain Specific Software Architecture (DSSA), and the DSSA approach to developing a system architecture, and describe the development process and the results of the ASAC EA system architecture. The document has six appendices. Author

Architecture (Computers); Systems Analysis; Technologies; Aeronautics; Research; Air Transportation

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970019588 NASA Langley Research Center, Hampton, VA USA
Identification of Linear and Nonlinear Aerodynamic Impulse Responses Using Digital Filter Techniques
Silva, Walter A., NASA Langley Research Center, USA; 1997; 14p; In English; Atmospheric Flight Mechanics, 11-13 Aug. 1997, New Orleans, LA, USA
Report No.(s): NASA-TM-112832; NAS 1.15:112832; AIAA Paper 97-3712; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the mathematical existence and the numerically-correct identification of linear and nonlinear aerodynamic impulse response functions. Differences between continuous-time and discrete-time system theories, which permit the

identification and efficient use of these functions, will be detailed. Important input/output definitions and the concept of linear and nonlinear systems with memory will also be discussed. It will be shown that indicial (step or steady) responses (such as Wagner's function), forced harmonic responses (such as Tbeodorsen's function or those from doublet lattice theory), and responses to random inputs (such as gusts) can all be obtained from an aerodynamic impulse response function. This paper establishes the aerodynamic impulse response function as the most fundamental, and, therefore, the most computationally efficient, aerodynamic function that can be extracted from any given discrete-time, aerodynamic system. The results presented in this paper help to unify the understanding of classical two-dimensional continuous-time theories with modem three-dimensional, discrete-time theories. First, the method is applied to the nonlinear viscous Burger's equation as an example. Next the method is applied to a three-dimensional aeroelastic model using the CAP-TSD (Computational Aeroelasticity Program - Transonic Small Disturbance) code and then to a two-dimensional model using the CFL3D Navier-Stokes code. Comparisons of accuracy and computational cost savings are presented. Because of its mathematical generality, an important attribute of this methodology is that it is applicable to a wide range of nonlinear, discrete-time problems.
Author
Digital Filters; Impulses; Navier-Stokes Equation; Computational Fluid Dynamics; Unsteady Aerodynamics; Aeroelasticity

19970019686 George Washington Univ., Joint Inst. for Advancement of Flight Sciences, Hampton, VA USA
An Approach to the Constrained Design of Natural Laminar Flow Airfoils
Green, Bradford E., George Washington Univ., USA; Feb. 1997; 78p; In English
Contract(s)/Grant(s): NCC1-24; RTOP 505-59-53--05
Report No.(s): NASA-CR-201686; NAS 1.26:201686; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A design method has been developed by which an airfoil with a substantial amount of natural laminar flow can be designed, while maintaining other aerodynamic and geometric constraints. After obtaining the initial airfoil's pressure distribution at the design lift coefficient using an Euler solver coupled with an integral turbulent boundary layer method, the calculations from a laminar boundary layer solver are used by a stability analysis code to obtain estimates of the transition location (using N-Factors) for the starting airfoil. A new design method then calculates a target pressure distribution that will increase the laminar flow toward the desired amount. An airfoil design method is then iteratively used to design an airfoil that possesses that target pressure distribution. The new airfoil's boundary layer stability characteristics are determined, and this iterative process continues until an airfoil is designed that meets the laminar flow requirement and as many of the other constraints as possible.
Author
Laminar Flow; Airfoils; Laminar Boundary Layer; Pressure Distribution; Iterative Solution; Design Analysis

19970020089 Wright Lab., Wright-Patterson AFB, OH USA
A Robust Gain-Scheduling Example User Linear Parameter-Varying Feedback
Spillman, Mark S., Wright Lab., USA; Blue, Paul A., Wright Lab., USA; Banda, Siva S., Wright Lab., USA; Lee, Lawton H., California Univ., USA; Jan. 1996; 21p; In English
Report No.(s): AD-A320237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A gain-scheduling approach for uncertain Linear Parameter-Varying (LPV) systems with fixed linear fractional relationships on a parameter set is developed. The approach combines LPV theory based on Linear Matrix Inequalities (LMIs) and synthesis to form a new robust approach for large envelope control design. The new approach is used to design an automatically gain scheduled pitch-rate controller for the F-16 Variable Stability InFlight Simulator Test Aircraft (VISTA). The ability of the approach to generate controllers for predicted Level 1 flying qualities is illustrated with a high fidelity nonlinear simulation.
DTIC
Approach Control; F-16 Aircraft; Flight Characteristics; Aerodynamic Stability; Flight Envelopes; Flight Simulation; Stability Tests

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970019567 Systems Resource Management, Inc., Kensington, MD USA
Proceedings of the FAA International Conference on Aircraft Inflight Icing, Volume 1, Plenary Sessions ***Final Report***
Riley, James, Compiler, Federal Aviation Administration, USA; Horn, Barbara, Compiler, Federal Aviation Administration, USA; Aug. 1996; 250p; In English, 5-6 May 1996, Springfield, VA, USA

Report No.(s): AD-A316438; DOT/FAA/AR-96/81-Vol-1; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The FAA International Conference on Aircraft Inflight Icing, held on May 6-8, 1996, in Springfield, Virginia, was attended by over 400 participants from the U.S. and nineteen foreign countries. The conference included a review of major aspects of airworthiness when operating in icing conditions. It consisted of an opening plenary session, five working group sessions addressing (1) Icing Environmental Characterization, (2) Ice Protection and Ice Detection, (3) Forecasting and Avoidance, (4) Requirements for and Means of Compliance in Icing Conditions (Including Icing Simulation Methods), (5) Operational Regulations and Training Requirements, and a closing plenary session. One of the primary areas of concern at the conference was icing due to supercooled large droplets (SLD). Volume 1 of the conference proceedings covers presentations of the speakers at the opening plenary session and the reports of the co-chairs of the working groups at the closing plenary session. Volume 2 of the conference proceedings is a compendium of technical papers presented in the various working groups.

DTIC

Aircraft Icing; Conferences; Deicing; Ice Formation; Aircraft Safety

19970019914 General Accounting Office, Office of Public Affairs, Washington, DC USA

Reports and Testimony: October 1966

Jan. 1996; 28p; In English

Report No.(s): AD-A318019; GAO/OPA-97-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Although both new and established air lines experience infrequent accidents, new airlines have higher rates, on average, than do established carriers. This does not mean that new airlines do not provide safe transportation, but it does demonstrate the need for better targeting of the Federal Aviation Administration's limited inspection resources. Nearly 4 million Medicare beneficiaries have opted to join health maintenance organizations, yet Medicare does not provide them with comparative consumer guides that are routine with employer-based health insurance plans. Comparative information is available and should be packaged and distributed to help consumers choose among competing Medicare HMOs. The USA in 1994 formed an international consortium to replace North Korea's nuclear reactors with a type that cannot be as easily used to produce materials for nuclear weapons. GAO cautions that the new reactors should not be commissioned until full liability protection is in place to protect consortium members from damages in case of a nuclear accident.

DTIC

Insurance (Contracts); Airline Operations; Civil Aviation; Commercial Aircraft

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970019309 Finnish Geodetic Inst., Kirkkonummi, Finland

Determining the GPS Orbit with the Dynamic Collocation Model, Volume 96

Quanwei, Liu, Finnish Geodetic Inst., Finland; 1996; ISSN 0355-1962; 20p; In English; Sponsored in part by the Centre for International Mobility of Finland and the Education Committee of China

Report No.(s): FGI-96-3; ISBN-951-711-197-5; Copyright; Avail: Issuing Activity (Finnish Geodetic Inst., Geodeetinrinne 2, (PL 15), FIN-02431 Masala, Finland), Hardcopy, Microfiche

A dynamic collocation model for Global Positioning System (GPS) orbits which can be used to obtain the combined solution of GPS satellite orbit parameters and tracking station coordinate corrections, is presented and discussed. In this model, orbit parameters, propagation medium effects and clock errors are considered to be random parameters and tracking station errors to be systematic parameters. to improve the accuracy of a priori statistic information and save computation time, a sequential algorithm suitable for a PC is proposed to be used in the adjustment. The refined orbit model for differential phase is also discussed in this paper.

Author

Global Positioning System; Orbit Calculation; Dynamic Models; Collocation

19970019512 Air Force Test Pilot School, Edwards AFB, CA USA

Satellite Navigation Using the Global Positioning System, Volume 3, Systems Phase

Riggins, Bob, Air Force Inst. of Tech., USA; Jan. 1996; 68p; In English

Report No.(s): AD-A320039; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

These notes are designed to accompany a 4 to 6 hour course. They provide a theoretical and practical foundation for understanding the Global Positioning System (GPS). Emphasis is on the use of GPS for determining navigational information such as user position and velocity relative to the local navigation frame of reference (latitude, longitude, altitude, and their time derivatives). Topics include history and motivation for OPS, basic properties of GPS, navigation solution theory, signal structure, code generation, code correlation, receiver design, ranging errors, geometrical errors, differential GPS, relative GPS, and carrier-phase GPS. by the conclusion of this course, the student will be able to write simple positioning algorithms given GPS pseudoranges. Also, the student will become well versed in the theoretical aspects of GPS, and so will be able to read and criticize current GPS research.
DTIC
Global Positioning System; Satellite Control; Navigation; Rangefinding

19970019755 Civil Aeromedical Inst., Oklahoma City, OK USA
An Analysis of Approach Control/Pilot Voice Communications ***Final Report***
Prinzo, O. Veronika, Civil Aeromedical Inst., USA; Oct. 1996; 40p; In English
Contract(s)/Grant(s): DTFA02-91-C-91089
Report No.(s): AD-A317528; DOT/FAA/AM-96/26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report consists of an analysis of air traffic control and pilot voice communications that occurred at 3 terminal air traffic control facilities (TRACONs). Each transmission was parsed into communication elements. Each communication element was assigned to a speech act category (e.g., address, instruction, request, advisory) and aviation topic (e.g., heading, altitude, speed, readback) and evaluated using the Aviation Topic-Speech Act Taxonomy (ATSAT, Prinzo, et al., 1995). A total of 12,200 communication elements in 4,500 transmissions make up the database. Communication elements appeared most frequently in the address and instruction speech act categories. of the 2,500 controller communication elements, 40% contained at least 1 communication error. The number and types of communication errors (message content and delivery technique) located within each speech act category were determined and separate communication error analyses are reported for pilots and controllers by TRACON facility. of the 5,900 pilot communicatio n elements, 59% contained at least 1 communication error. More than 50% of controllers and pilots communication errors occurred in the instruction speech act category. Generally, controllers omitted key words that pertained to radio frequency, airspeed, or approach/departure instructions. Pilots only partially read back instructions involving heading, radio frequency, and airspeed aviation topics and grouped numbers in a radio frequency, airspeed, or heading. Pilots and controllers communications became more conversational and verbose when their transmissions included advisory or request speech acts. Omitting and grouping numbers in transmissions may be strategies used to minimize time on frequency. Ironically, these strategies may create the problems that pilots and controllers are trying to prevent.
DTIC
Voice Communication; Speech Recognition; Air Traffic Control; Controllers; Integrated Mission Control Center

19970020048 National Aerospace Lab., NAL/NASDA HOPE Team ALFLEX Group, Tokyo, Japan
System Design of the Automatic Landing Flight Experiment (ALFLEX)
Nov. 1996; ISSN 0389-4010; 82p; In Japanese
Report No.(s): NAL-TR-1313; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The National Aerospace Laboratory and the National Space Development Agency of Japan are developing an unmanned space re-entry system called HOPE which is planned for launch by an H-II rocket. At the preliminary stage of this project, research on the automatic landing using a dynamically scaled model of HOPE is currently being conducted. The model is called ALFLEX which is an abbreviation of the Automatic Landing Flight EXperiment. The objectives of ALFLEX are to establish the fundamental technology necessary for the landing of HOPE, including the design methodology of the navigation, guidance and control system, and the evaluation method for the flight experiments using a subscale model. The 37% scaled ALFLEX vehicle is lifted by a carrier helicopter up to a height of 1,500 m and is released at a level speed of 46 m/s. Then, relying upon an integrated guidance system, it captures the specified glide slope and lands horizontally on a 1,000 m long runway. The present paper describes the results of the preliminary ALFLEX system design.
Author
Automatic Landing Control; Flight Control; Reentry Vehicles; Design

19970020081 National Aeronautical Lab., Tokyo, Japan
MLS Angle Accuracy of the MIAS Flight Test
Inokuchi, H., National Aeronautical Lab., Japan; Zaayer, M., Technische Hogeschool, Netherlands; Sridhar, J. K., Technische Hogeschool, Netherlands; Mulder, J. A., Technische Hogeschool, Netherlands; Nov. 1996; ISSN 0389-4010; 22p; In English

Report No.(s): NAL-TR-1314T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Multi-mode Integrated Approach System (MIAS) is under development at Delft University of Technology (DUT), the Netherlands. The system is an advanced approach system based on the Microwave Landing System (MLS) and the Differential Global Positioning System (DGPS). Since the MIAS uses two independent systems, the availability of the system and the maintainability of each subsystem can be increased. Flight tests were performed at Amsterdam's Schiphol airport in 1994 to evaluate the performance of the system. This report describes the flight test results of the MIAS in 1994. The MLS data was compared with the true reference obtained from carrier phase DGPS. In the case of a straight approach, the accuracy of the MLS elevation angle in this flight test equipment was approximately 0.015 degrees (1 sigma) except for a bias. The mean of the bias was approximately 0.025 degrees. The accuracy of the MLS azimuth angle was approximately 0.015 (1 sigma) degrees except for a bias. The mean of the bias was approximately 0.075 degrees. In the case of take off and steep turn, the accuracy of the MLS angle decreased. Author

Microwave Landing Systems; Flight Tests; Air Navigation; Approach

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970019335 General Accounting Office, Washington, DC USA

Unmanned Aerial Vehicles: DOD's Acquisition Efforts

Rodrigues, Louis J., General Accounting Office, USA; Apr. 09, 1997; 20p; In English

Report No.(s): GAO/T-NSIAD-97-138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

According to DOD, its objective in acquiring UAVs is to provide unmanned systems that will complement its mix of manned and national reconnaissance assets. However, its UAV acquisition efforts to date have been disappointing. Since Aquila began in 1979, of eight UAV programs, three have been terminated (Aquila, Hunter, Medium Range), three remain in development (Outrider, Global Hawk, DarkStar), and one is now transitioning to low rate production (Predator). Only one of the eight, Pioneer, has been fielded as an operational system. We estimate DOD has spent more than $2 billion for development and/or procurement on these eight UAV programs over the past 18 years.

Derived from text

Pilotless Aircraft; Remotely Piloted Vehicles; Acquisition; Projects

19970019396 Air Force Test Pilot School, Edwards AFB, CA USA

Flying Qualities Phase. Planning Guide

Mar. 1996; 319p; In English

Report No.(s): AD-A319971; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The purpose of this text is to provide an aid to the student for planning flights in the Flying Qualities Phase of the USAFTPS curriculum. In the Performance Phase, your evaluation of an aircraft tended to focus on objective data. Flying qualities flight test is much more than just comparing the results of a flight test to the applicable military standard. In the Flying Qualities (FQ) Phase, you will be greatly expanding your role as a subjective evaluator, as it is the pilot's opinion of how well an airplane flies its intended mission that often determines its fate. In this phase, you learn how to make an overall assessment of an aircraft's flying and handling qualities relative to a specific mission using a very deliberate, build-up approach. At the center is the model validation test method--predict the airplane response, based on a model; test the prediction; and validate or correct the model, based on test results. This method will be introduced and used as a template for testing. The challenges to flight control system design and test posed by aerodynamic, structural, flight control, and handling qualities models will be explored in the flying qualities phase. Finally, to augment yo ur flying qualities test abilities, classical, more first-order techniques for determining military standard compliance will also be taught and practiced during this phase of training.

DTIC

Aerodynamics; Control Systems Design; Flight Simulators; Aerodynamic Stability; Flight Tests; Flight Control; Flight Training; Flight Simulation

19970019673 Bell Helicopter Co., Structures Research and Development, Fort Worth, TX USA

Tiltrotor Transport Bonded Wing Design Summary

Dompka, Robert V., Bell Helicopter Co., USA; Holzwarth, Richard C., Wright Lab., USA; Jan. 1997; 12p; In English; Also announced as 19970019652; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the results of research and development activities conducted under Air Force contract by Bell Helicopter Textron, Inc. (Bell) to apply advanced design and manufacturing technology to reduce production costs of a composite tiltrotor transport vehicle wing. Strength, stiffness, and weight requirements dictated the utilization of advanced composites. This paper will provide a description of the effects of these requirements on wing torque box design and the analysis used to size major structural components and joints. Component verification test results are provided to support the design decisions and validate the analyses and structural integrity. Future plans are presented for a full-scale torque box structural test as demonstration of the viability of the final design.
Author
Bell Aircraft; Aircraft Design; Wings; Structural Failure; Structural Design; Helicopters; Composite Structures; Composite Materials

19970019733 Federal Aviation Administration, Hughes Technical Center, Atlantic City, NJ USA
Engineering Approach to Damage Tolerance Analysis of Fuselage Skin Repairs ***Final Report***
Bakuckas, J. G., Jr., Federal Aviation Administration, USA; Chen, C. C., McDonnell-Douglas Aerospace, USA; Yu, J., McDonnell-Douglas Aerospace, USA; Tan, P. W., Federal Aviation Administration, USA; Bigelow, C. A., Federal Aviation Administration, USA; Nov. 1996; 29p; In English
Report No.(s): AD-A320011; DOT/FAA/AR-95/75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simplified approach to damage tolerance analysis of riveted fuselage skin repairs has been incorporated in a new user-friendly software package, Repair Assessment Procedure and Integrated Design (RAPID). In this study, the damage tolerance analysis methodology in RAPID was evaluated in terms of the fastener loads, stress-intensity factor solutions, crack growth, residual strength, and inspection schedule. Three example problems, each representing a typical fuselage skin repair configuration, were analyzed. The analysis results obtained from RAPID were compared with results generated using a Representative Original Equipment Manufacturer (ROEM) method and a special purpose finite element program for fracture mechanics analysis and crack growth simulation in layered two dimensional structures. In general, results generated using RAPID were in good agreement with results generated using the ROEM method and the finite element code.
DTIC
Applications Programs (Computers); Fuselages; Fracture Mechanics; Finite Element Method; Fasteners; Maintenance; Tolerances (Mechanics); Damage Assessment

19970019740 Mississippi Univ., University, MS USA
Instrumentation for Investigating Precursors to High Reynolds Number Unsteady Flow Separation on Pitching Airfoils ***Final Report, 15 Jul. 1994 - 14 Jul. 1995***
Sinha, Sumon K., Mississippi Univ., USA; Pal, Dipankar, Mississippi Univ., USA; Banerjee, Debjyoti, Mississippi Univ., USA; Pandey, Mukesh, Mississippi Univ., USA; Baker, Chuck, Mississippi Univ., USA; Sep. 10, 1996; 50p; In English
Contract(s)/Grant(s): DAAH04-93-G-0451
Report No.(s): AD-A316875; ARO/FRI/996; ARO-32404.1-EG-DPS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A pitching airfoil test facility has been developed to enable investigating the unsteady flow separation process on helicopter rotor blades under flow conditions which replicate the viscous-inviscid interactions. The facility is capable of operating at chord based Reynolds numbers of 106 and reduced frequencies of 0.23 while maintaining the Mach number below 0.15. A multi-element compliant wall sensor has been developed to measure pressure fluctuations just preceding the emption of the boundary layer. Following successful implementation on cylinders and non-pitching airfoils, this transducer has been used to detect the propagation of wall pressure fluctuations in the neighborhood of the separation point. Preliminary data obtained by sampling simultaneously the data from eight transducer strips has revealed patterns characteristic to the boundary layer emption process.
DTIC
Unsteady Flow; High Reynolds Number; Airfoils; Boundary Layer Separation

19970019912 Naval Postgraduate School, Dept. of Aeronautics and Astronautics, Monterey, CA USA
A Historical Perspective of Aircrew Systems Effects on Aircraft Design
Bauer, David O., Naval Postgraduate School, USA; Sep. 1996; 112p; In English
Report No.(s): AD-A320281; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The design of the aircrew workstation often has not been an orderly part of the overall aircraft design process but rather of much lower priority than the integration of the airframe and powerplant. However, the true test of the aircraft is how well the aircrew can use the aircraft for mission performance. NAVAIR has been seeking the establishment of an Aircrew Centered System

Design discipline, to be addressed as an integral part of the global aircraft system design process. A baseline, historical understanding of how the aircrew have been integrated into the aircraft and mission is needed. An analysis was conducted of several significant airplanes from the Wright Flyer to the present, seeking those design factors which affected how well the aircrew were able to perform the design mission. The physical and attentional resources of the aircrew must be understood and accommodated by those designing the cockpit and other workstations. Aircrew members who are knowledgeable of, and experienced in the intended mission must be involved in the design process from the very earliest phases of concept definition.
DTIC
Aircraft Design; Human Factors Engineering; Flight Crews; Design Analysis

19970019923 NASA Dryden Flight Research Center, Edwards, CA USA
Predicted Performance of a Thrust-Enhanced SR-71 Aircraft with an External Payload
Conners, Timothy R., NASA Dryden Flight Research Center, USA; Jun. 1997; 16p; In English; International Gas Turbine and Aeroengine, 5-8 Jun. 1996, Houston, TX, USA
Contract(s)/Grant(s): RTOP 242-33-02-00-23
Report No.(s): NASA-TM-104330; H-2179; NAS 1.15:104330; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
NASA Dryden Flight Research Center has completed a preliminary performance analysis of the SR-71 aircraft for use as a launch platform for high-speed research vehicles and for carrying captive experimental packages to high altitude and Mach number conditions. Externally mounted research platforms can significantly increase drag, limiting test time and, in extreme cases, prohibiting penetration through the high-drag, transonic flight regime. To provide supplemental SR-71 acceleration, methods have been developed that could increase the thrust of the J58 turbojet engines. These methods include temperature and speed increases and augmentor nitrous oxide injection. The thrust-enhanced engines would allow the SR-71 aircraft to carry higher drag research platforms than it could without enhancement. This paper presents predicted SR-71 performance with and without enhanced engines. A modified climb-dive technique is shown to reduce fuel consumption when flying through the transonic flight regime with a large external payload. Estimates are included of the maximum platform drag profiles with which the aircraft could still complete a high-speed research mission. In this case, enhancement was found to increase the SR-71 payload drag capability by 25 percent. The thrust enhancement techniques and performance prediction methodology are described.
Author
Performance Prediction; SR-71 Aircraft; Turbojet Engines; Prediction Analysis Techniques; Payloads; Nitrous Oxides

19970020047 National Aerospace Lab., Tokyo, Japan
Development of Flight Simulation Program for the HYFLEX Vehicle and Flight Analysis
Suzuki, Hirokazu, National Aerospace Lab., Japan; Matsumoto, Yoshiaki, Mitsubishi Space Software Corp., Japan; Jan. 1997; ISSN 0389-4010; 58p; In Japanese
Report No.(s): NAL-TR-1317; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This paper describes a flight simulation program used to analyze the navigation, guidance and control system, and for flight analysis of the hypersonic flight experiment vehicle (HYFLEX). Up to this time, the earth had been considered as a sphere at NAL. The flight simulation was carried out using the model at the pre-design phase of the HYFLEX. However, more precise flight analysis had to be carried out to predict the splash down point as we planned to recover the HYFLEX vehicle. In this paper, two coordinate systems were introduced to deal with the earth as a ellipsoid of revolution, and new equations of motion were derived. to maintain precision, two state vectors were redefined. The designed navigation, guidance and control system of the HYFLEX is proved to satisfy the mission requirements through the results of flight analysis. Further, more accurate data of the nominal impact point and dispersion of the impact point are obtained.
Author
Flight Simulation; Guidance (Motion); Navigation; Hypersonic Vehicles

19970020049 National Aerospace Lab., Flight Research Div., Tokyo, Japan
Wind Model near a High Building for Helicopter Flight Simulator
Harada, Masashi, National Aerospace Lab., Japan; Okuno, Yoshinori, National Aerospace Lab., Japan; Nov. 1996; ISSN 0389-4010; 24p; In Japanese
Report No.(s): NAL-TR-1311; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Simulation tests of a fire helicopter for high buildings are being conducted by the National Aerospace Laboratory (NAL) and in cooperation with the Tokyo Fire Department. Many factors affect the mission of fire helicopters. One of the most important factors is the heavily turbulent wind and shear forces near high buildings. In simulating the mission of the fire fighting, it is necessary to generate the wind in real time depending on both the time and location of the measuring point. When the height of the

building is assumed to be infinite, it is possible to simulate wind by using a two dimensional Discrete Vortex Method. It is also shown that this method is adaptive to simulate wind around the building whose height is comparable to its width.
Author
Fire Fighting; Helicopters; Flight Simulators; Wind Effects; Buildings; Simulation

19970020426 Defence Science and Technology Organisation, Aeronautical andMaritime Research Lab., Melbourne, Australia
The Static Testing of a Lockheed P-3 Orion Wing Leading Edge Center Section
Wong, Albert K., Defence Science and Technology Organisation, Australia; Luke, Glenn, Defence Science and Technology Organisation, Australia; Nov. 1996; 79p; In English; Original contains color illustrations
Report No.(s): DSTO-TR-0423; AR-009-899; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report documents the design of the test rig and the results of the static test of the Lockheed P-3 Orion Wing Leading Edge centre section structure. The test comprised of two parts, viz., the validation of the structural integrity of the structure under design load conditions, and the determination of the static strength of the structure for the local transonic flight regime within which the RAAF Orion A9-754 had evidently failed. The test dearly showed that the structure meets its design specifications and had an adequate margin of safety even for the high speed regime. However, it is pointed out that this margin can be quickly eroded if the material thickness is below specification, as was reported for the case of Orion A9-754, and it is recommended that this aspect be investigated for the RAAF Orion fleet.
Author
Design Analysis; Rigging; Structural Failure; Experiment Design

19970020438 National Aerospace Lab., Tokyo, Japan
Simulation Study for a Fire Helicopter, Part 3, Operational Simulation for a Fire Helicopter
Funabiki, Kohei, National Aerospace Lab., Japan; Okuno, Yoshinori, National Aerospace Lab., Japan; Muraoka, Koji, National Aerospace Lab., Japan; Wakairo, Kaoru, National Aerospace Lab., Japan; Oct. 1996; ISSN 0389-4010; 20p; In Japanese
Report No.(s): NAL-TR-1308; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A piloted flight simulation is carried out to investigate operational subjects such as crew coordination between pilots and the boom operator, emergency operations, and acceptability of the interfaces. The simulated operations were so defined as to involve the whole operation from take off to landing, including two sets of fire fighting operations and water recharging. It is concluded that the pilot-flying should request the pilot not flying and the boom operator to call out necessary information such as heading, distance from the building, and margin of the ejection boom control range. Furthermore the pilots concluded that a side mounted distance indicator which can be seen when looking outside the cockpit is effective in maintaining a proper distance from the building. A simulation for a one engine inoperative condition during fire fighting is also carried out. A series of other operations, such as the dumping of remaining water, retraction of the boom, and acceleration and escape from the building were also conducted smoothly.
Author
Flight Simulation; Helicopters

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19970019542 NASA Lewis Research Center, Cleveland, OH USA
Evaluation of Water Injection Effect on NO(x) Formation for a Staged Gas Turbine Combustor ***Final Report***
Fan, L., Michigan Technological Univ., USA; Yang, S. L., Michigan Technological Univ., USA; Kundu, K. P., NASA Lewis Research Center, USA; Jan. 18, 1996; 11p; In English; 34th; Aerospace Sciences, 15-18 Jan. 1996, Reno, NV, USA
Contract(s)/Grant(s): NCC3-406; NAG3-1109
Report No.(s): NASA-CR-204498; NAS 1.26:204498; AIAA Paper 96-0706; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NO(x) emission control by water injection on a staged turbine combustor (STC) was modeled using the KIVA-2 code with modification. Water is injected into the rich-burn combustion zone of the combustor by a single nozzle. Parametric study for different water injection patterns was performed. Results show NO(x) emission will decrease after water being injected. Water nozzle

location also has significant effect for NO formation and fuel ignition. The chemical kinetic model is also sensitive to the excess water. Through this study, a better understanding of the physics and chemical kinetics is obtained, this will enhance the STC design process.
Author
Water Injection; Reaction Kinetics; Combustion Chambers; Combustion

19970019731 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
Analysis of the Effect of Liquid Film Cooling on the Performance of the Two-Component Attitude Control Engine
Li, Ping; Wang, Yin-Fang; Astronautics and Missilery Abstracts; Sep. 30, 1996; Volume 3, No. 1, pp. 1-8; In English
Contract(s)/Grant(s): F33657-88-D-2188
Report No.(s): AD-A316770; NAIC-ID(RS)T-0320-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By analyzing the operational characteristics of liquid film/radiation cooling of a two-component attitude control engine based on the swirling suction models of two side-zone flow pipes, the authors of this paper divided the combustion chamber flow field approximately into one central zone and two side zones, and calculated the effect of the liquid film cooling of the liquid film/radiation cooling low-thrust liquid rocket engine on its performance loss. Also discussed are the performance analysis results together with the selection of the engine design parameters for an integrated thermal conductivity model. The method presented in this paper can be regarded as a reference for performance calculation and parameter optimization in the design of similar engines.
DTIC
Evaluation; Film Cooling; Fluid Films; Engine Design

19970019929 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Optimum Design of High-Speed Prop-Rotors ***Final Report***
Chattopadhyay, Aditi, Arizona State Univ., USA; McCarthy, Thomas Robert, Arizona State Univ., USA; 1993; 85p; In English
Contract(s)/Grant(s): NAG2-771
Report No.(s): NASA-CR-204285; NAS 1.26:204285; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An integrated multidisciplinary optimization procedure is developed for application to rotary wing aircraft design. The necessary disciplines such as dynamics, aerodynamics, aeroelasticity, and structures are coupled within a closed-loop optimization process. The procedure developed is applied to address two different problems. The first problem considers the optimization of a helicopter rotor blade and the second problem addresses the optimum design of a high-speed tilting proprotor. In the helicopter blade problem, the objective is to reduce the critical vibratory shear forces and moments at the blade root, without degrading rotor aerodynamic performance and aeroelastic stability. In the case of the high-speed proprotor, the goal is to maximize the propulsive efficiency in high-speed cruise without deteriorating the aeroelastic stability in cruise and the aerodynamic performance in hover. The problems studied involve multiple design objectives; therefore, the optimization problems are formulated using multiobjective design procedures. A comprehensive helicopter analysis code is used for the rotary wing aerodynamic, dynamic and aeroelastic stability analyses and an algorithm developed specifically for these purposes is used for the structural analysis. A nonlinear programming technique coupled with an approximate analysis procedure is used to perform the optimization. The optimum blade designs obtained in each case are compared to corresponding reference designs.
Author
Rotary Wing Aircraft; Dynamic Structural Analysis; Aerodynamics; Aeroelasticity; Optimization; Hovering; Aerodynamic Characteristics; Aircraft Design

19970020064 Wright Lab., Flight Dynamics Directorate, Wright-Patterson AFB, OH USA
Bifurcation Based Nonlinear Feedback Control for Rotating Stall in Axial Compressors
Gu, Guo-Xiang, Louisiana State Univ., USA; Sparks, Andrew, Wright Lab., USA; Banda, Siva, Wright Lab., USA; Apr. 1996; 18p; In English
Contract(s)/Grant(s): F49620-94-I-0415
Report No.(s): AD-A320346; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Classical bifurcation analysis for nonlinear dynamics is used to derive a nonlinear feedback control law that eliminates the hysteresis loop associated with rotating stall and extends the stable operating range in axial compressors. The proposed control system employs pressure rise as output measurement and throttle position as actuating signal for which both sensor and actuator exist in the current configuration of axial compressors. Thus our results provide a practical solution for rotating stall control in axial compressors.
DTIC
Turbocompressors; Feedback Control; Nonlinear Feedback; Rotating Stalls; Aircraft Engines; Branching (Mathematics)

19970020381 NASA Dryden Flight Research Center, Edwards, CA USA

F/A-18A Inlet Flow Characteristics During Maneuvers with Rapidly Changing Angle of Attack

Yuhas, Andrew J., Analytical Services and Materials, Inc., USA; Steenken, William G., General Electric Co., USA; Williams, John G., General Electric Co., USA; Walsh, Kevin R., NASA Dryden Flight Research Center, USA; Jun. 1997; 24p; In English; High Angle-of-Attack Technology, 17-19 Sep. 1996, Hampton, VA, USA

Contract(s)/Grant(s): NAS3-26617; RTOP 505-68-30

Report No.(s): NASA-TM-104327; NAS 1.15:104327; H-2146; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance and distortion levels of the right inlet of the F/A-18A High Alpha Research Vehicle were assessed during maneuvers with rapidly changing angle-of-attack at the NASA Dryden Flight Research Center, Edwards, California. The distortion levels were compared with those produced by current inlet-engine compatibility evaluation techniques. The objective of these analyses was to determine whether the results obtained for steady aerodynamic conditions were adequate to describe the inlet-generated distortion levels that occur during rapid aircraft maneuvers. The test data were obtained during 46 dynamic maneuvers at Mach numbers of 0.3 and 0.4. Levels of inlet recovery, peak dynamic circumferential distortion, and peak dynamic radial distortion of dynamic maneuvers for a General Electric F404-GE-400 turbofan engine were compared with estimations based on steady aerodynamic conditions. The comparisons were performed at equivalent angle-of-attack, angle-of-sideslip, and Mach number. Results showed no evidence of peak inlet distortion levels being elevated by dynamic maneuver conditions at high angle-of-attack compared with steady aerodynamic estimations. During sweeps into high angle-of-attack, the peak distortion levels of the dynamic maneuvers rarely rose to steady aerodynamic estimations. The dynamic maneuvers were shown to be effective at identifying conditions when discrete changes in inlet behavior occur.

Author

Research Vehicles; Angle of Attack; Turbofan Engines; Aircraft Maneuvers; Inlet Flow; Flow Characteristics; Wind Tunnel Tests; Pressure Measurement

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19970019337 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany

A New Control System Concept for Reconfiguration in Case of Control Effector Failures ***Ein neues Flugregelungskonzept zur Rekonfiguration bei Stellgliedfehlern***

Baumgarten, Goetz, Technische Univ., Germany; Sep. 1996; 144p; In German

Report No.(s): DLR-96-22; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A new reconfiguration concept for flight control systems dealing with control effector failures is presented. Failure types of reduced control surfaces effectiveness, stuck surfaces, reduced actuator rate limits, and reduced deflection limits are considered. The model following control system includes an explicit aircraft model in the feedforward part representing the aircraft in the current fault condition. The reconfigured control system activates additional control effectors to maintain a satisfactory command following. The attainable performance index depends on the accuracy of the failure information available for the reconfiguration. An evolution algorithm is developed to increase the accuracy of the failure information. With this, the reconfiguration and the control performance are improved. Various simulation examples underline the efficiency of the concept. The simulations are carried out with a high precision model of ATTAS, a modified VFW-614 of DLR.

Author

Flight Control; Feedforward Control; Genetic Algorithms; Parameter Identification; Aircraft Control

19970019345 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Stick and Feel System Design ***Systemes de restitution des efforts au manche***

Gibson, J. C., Gibson (J. C.), UK; Hess, R. A., California Univ., USA; Mar. 1997; 180p; In English

Report No.(s): AGARD-AG-332; ISBN-92-836-1051-2; Copyright Waived; Avail: CASI; A09, Hardcopy; A02, Microfiche

Since the earliest days of manned flight, designers have sought to assist the pilot in the performance of tasks by using stick and feel systems to bring these tasks within the bounds of human physical capabilities. This volume describes stick and feel systems in two parts. Part one describes the technologies which have been developed throughout the history of 20th Century aviation. Part two describes how modern systems dynamics interact with the human pilot. It is hoped that the design lessons and approaches

outlined in this volume will contribute to a better understanding and appreciation of the importance of force-feel system design in aircraft/rotorcraft flight control.
Derived from text
Aircraft Control; Flight Control; Pilot Performance; Control Sticks; Control Theory; Man Machine Systems; Human Factors Engineering; Fly by Wire Control

19970019580 National Aerospace Lab., Tokyo, Japan
Compensation of ADS Side-Slip Angle using Information of Inertial Velocity
Yanagihara, Masaaki, National Aerospace Lab., Japan; Nagayasu, Masahiko, National Aerospace Lab., Japan; Motoda, Toshikazu, National Aerospace Lab., Japan; Sep. 1996; ISSN 0389-4010; 38p; In Japanese
Report No.(s): NAL-TR-1305; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Comparing lateral acceleration control and side-slip angle control as lateral-directional control of aircraft side-slip angle control is superior in the response to turbulence, but it requires the use of an air-data-sensor (ADS) which has larger observation noise than the inertial sensor used in lateral acceleration control. In Automatic Landing Flight Experiments (ALFLEX), side-slip angle control is adopted, but damping of the ADS pitot probe was less than the predicted value. As a result, the lateral-directional motion has an unstable mode caused by measurement noise of the ADS side-slip angle. In this report, a new method to compensate ADS side-slip angle using inertial velocity information is proposed. The method is evaluated using mathematical simulation of ALFLEX vehicle and compared with a simpler method in which measurement noise is removed by a low-pass filter. The results are as follows: (1) In a simple method using a low-pass filter, the motion of the vehicle diverges since inertial motion is also filtered; and (2) In a newly proposed method, the vehicle can fly under turbulence, and it is proved that the method is useful.
Author
Sideslip; Aircraft Control; Lateral Control; Directional Control; Turbulence; Mathematical Models

19970019598 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA
Spin-Tunnel Investigation of a 1/28-Scale Model of the NASA F-18 High Alpha Research Vehicle (HARV) with and without Vertical Tails
Fremaux, C. Michael, Lockheed Martin Engineering and Sciences Co., USA; Apr. 1997; 46p; In English
Contract(s)/Grant(s): NAS1-19000; RTOP 522-25-31-02
Report No.(s): NASA-CR-201687; NAS 1.26:201687; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation was conducted in the NASA Langley 20-Foot Vertical Spin Tunnel to determine the developed spin and spin-recovery characteristics of a 1/28-scale, free-spinning model of the NASA F-18 HARV (High Alpha Research Vehicle) airplane that can configured with and without the vertical tails installed. The purpose of the test was to determine what effects, if any, the absence of vertical tails (and rudders) had on the spin and spin-recovery capabilities of the HARV. The model was ballasted to dynamically represent the full-scale airplane at an altitude of 25,000 feet. Erect and inverted spin tests with symmetric mass loadings were conducted with the free-spinning model. The model results indicate that the basic airplane with vertical tails installed (with unaugmented control system) will exhibit fast, flat erect and inverted spins from which acceptable recoveries can be made. Removing the vertical tails had little effect on the erect spin mode, but did degrade recoveries from erect spins. In contrast, inverted spins without the vertical tails were significantly more severe than those with the tails installed.
Author
Spin Tests; Research Vehicles; Tail Assemblies; Reynolds Number; Wind Tunnel Tests

19970019603 NASA Dryden Flight Research Center, Edwards, CA USA
Coupling Dynamics in Aircraft: A Historical Perspective
Day, Richard E., NASA Dryden Flight Research Center, USA; Mar. 1997; 74p; In English
Contract(s)/Grant(s): NAS2-13445; RTOP 953-36-00
Report No.(s): NASA-SP-532; NAS 1.21:532; H-2106; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Coupling dynamics can produce either adverse or beneficial stability and controllability, depending on the characteristics of the aircraft. This report presents archival anecdotes and analyses of coupling problems experienced by the X-series, Century series, and Space Shuttle aircraft. The three catastrophic sequential coupling modes of the X-2 airplane and the two simultaneous unstable modes of the X-15 and Space Shuttle aircraft are discussed. In addition, the most complex of the coupling interactions, inertia roll coupling, is discussed for the X-2, X-3, F-100A, and YF-102 aircraft. The mechanics of gyroscopics, centrifugal effect, and resonance in coupling dynamics are described. The coupling modes discussed are interacting multiple degrees of freedom

of inertial and aerodynamic forces and moments. The aircraft are assumed to be rigid bodies. Structural couplings are not addressed. Various solutions for coupling instabilities are discussed.
Author
F-100 Aircraft; X-15 Aircraft; Aerodynamic Forces; Inertia; Interactions

19970019927 NASA Lewis Research Center, Cleveland, OH USA
Clarification of 'Turn Performance of Aircraft'
Ford, William F., NASA Lewis Research Center, USA; SIAM Review; Jun. 1996; Volume 38, No. 2, pp. 309-312; In English
Report No.(s): NASA-TM-112762; NAS 1.15:112762; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
A recent note analyzed the minimum turning radius of an airplane in terms of its airspeed and angle of bank. Unfortunately, some misconceptions concerning the underlying physics were introduced. This note is intended to clarify those areas.
Author
Aircraft Performance; Lift; Turning Flight

19970020221 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Roll Angle and Ball Width Data Method Based on Dynamic Pressure for Helicopter Applications
Kolwey, Herman, Naval Air Warfare Center, USA; Sep. 27, 1996; 35p; In English
Report No.(s): AD-A316884; NAWCADPAX--96-9-TM; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A search of MH-53E and CH-53E roll angle, ball width, and sideslip data was conducted in order to establish Fleet Steady Heading SideSlip (SHSS) NATOPS limits for aircraft lacking nose booms. No ball width data were found for the CH-53H. Plots of the available information were sent to NAVTESTPILOTSCH (Bob Miller). He suggested that the data (three different slopes) might be normalized to one slope, using a velocity squared ratio as is done for fixed-wing aircraft. Doing this collapsed the data to a single line. An NH data plot was made (roll angle versus ball width - believed to be linear for SHSS conditions) and used to calculate CH ball width from roll angle data. AH-lW data to 125 KIAS containing ball 'pegged' (against the limit of travel) points were handled similarly, allowing extrapolation to 170 KIAS. A family of curves was then generated (both course and fine) for the Cobra as a function of airspeed. Finally, lateral g sensitivity was derived from a plot of ball width versus roll angle, allowing correction of a lateral g-driven (accelerometer) ball indication in a helmet mounted display. This process is recommended for use in handling roll angle and ball width information in flight simulations. Consideration should be given to incorporating this method into the NAVTESTPILOTSCH curriculum.
DTIC
Dynamic Pressure; Angles (Geometry); Aircraft Configurations; Helicopters; Fixed Wings

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970019392 National Aerospace Lab., Tokyo, Japan
Suspending Wind-Tunnel Test for the ALFLEX Vehicle
Sep. 1996; ISSN 0389-4010; 32p; In Japanese
Report No.(s): NAL-TR-1306; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A suspending wind-tunnel test for the Automatic Landing Flight Experiment (ALFLEX) was conducted as a part of the research on an unmanned winged re-entry vehicle (HOPE). The suspending flight was simulated in the wind-tunnel using a 40% scaled model of the ALFLEX vehicle to validate the design of the suspending system and to identify the aerodynamic characteristics of the vehicle for designing a control system. As a result, problems of some elements of the system are identified and a counter plan is considered. It is concluded that the system works well except for these problems, and that there is not much difference between the actual aerodynamic characteristics and the predicted ones used in designing the vehicle. The flight test plan of ALFLEX is then fixed based on these results.
Author
Automatic Landing Control; Wind Tunnel Tests; Reentry Vehicles; Suspension Systems (Vehicles); Aerodynamic Characteristics

19970019543 Applied Research Associates, Inc., South Royaltan, VT USA

Demonstration and Evaluation of the Air Force Site Characterization and Analysis Penetrometer System in Support of Natural Attenuation Initiatives, Volume 3, Demonstration, Testing, and Evaluation at Patrick AFB ***Final Report, Oct. 1993 - Dec. 1994***

Gildea, Martin L., Applied Research Associates, Inc., USA; Bratton, Wesley L., Applied Research Associates, Inc., USA; Shinn, James D., II, Applied Research Associates, Inc., USA; Feb. 09, 1996; 87p; In English

Report No.(s): AD-A317180; ARA-5868-Vol-3; AL/EQ-TR-1995-Vol-3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A second-generation tunable Laser-Induced Fluorescence-Cone Penetrometer Test (LIF-CPT) system has been developed and demonstrated at three different Air Force Bases as an alternative site characterization technology. This represents an innovative technology for delineating soil contamination resulting from fuel spills. Applied Research Associates, Inc. and Dakota Technologies, Inc. jointly conducted the system development and demonstration project. Demonstrations consisted of 2-week efforts at each of Air Force Bases: Plattsburgh Patrick/Cape Canaveral, and Dover. The data collected during these demonstration supported both evaluation of the LIF-CPT systems along with support for selecting a site for a natural attenuation experiment the Air Force is planning. Data analysis indicates that the second generation system is operationally improved over the first-generation system and has improved detection capabilities. The improved detection capability is related to a new optical module used to focus laser light and filter the return signal to reduce the signal-to-noise ratio. Although the system is improved in many ways, some questions still exist concerning the influence soil type has had on some of the system responses. Further analysis is required to resolve these discrepancies.

DTIC

Laser Induced Fluorescence; SOIl Pollution; Data Processing

19970019553 Applied Research Associates, Inc., South Royaltan, VT USA

Demonstration and Evaluation of the Air Force Site Characterization and Analysis Penetrometer System in Support of Natural Attenuation Initiatives, Volume 5, LIF System 0peration and Maintenance Manual ***Final Report, Oct. 1993 - Dec. 1994***

Gildea, Martin L., Applied Research Associates, Inc., USA; Bratton, Wesley L., Applied Research Associates, Inc., USA; Shinn, James D., II, Applied Research Associates, Inc., USA; Feb. 09, 1996; 56p; In English

Contract(s)/Grant(s): F08635-93-C-0020

Report No.(s): AD-A317188; ARA-5868-Vol-5; AL/EQ-TR-1995-0013-Vol-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A second-generation tunable Laser-Induced Fluorescence-Cone Penetrometer Test (LIF-CPT) system has been developed and demonstrated at three different Air Force Bases as an alternative site characterization technology. This represents an innovative technology for delineating soil contamination resulting from fuel spills. Applied Research Associates, Inc. and Dakota Technologies, Inc. jointly conducted the system development and demonstration project. Demonstrations consisted of 2-week efforts at each of Air Force Bases: Plattsburgh Patrick/Cape Canaveral, and Dover. The data collected during these demonstration supported both evaluation of the LIF-CPT systems along with support for selecting a site for a natural attenuation experiment the Air Force is planning. Data analysis indicates that the second generation system is operationally improved over the first-generation system and has improved detection capabilities. The improved detection capability is related to a new optical module used to focus laser light and filter the return signal to reduce the signal-to-noise ratio. Although the system is improved in many ways, some questions still exist concerning the influence soil type has had on some of this system responses. Further analysis is required to resolve these discrepancies.

DTIC

Laser Induced Fluorescence; SOIl Pollution; Fuel Contamination

19970019617 Charles River Analytics, Inc., Cambridge, MA USA

An Intelligent Flight Trainer for Initial Entry Rotary Wing Training ***Final Report, Jul. 1993 - Dec. 1995***

Mulgund, Sandeep S., Charles River Analytics, Inc., USA; Zacharias, Greg L., Charles River Analytics, Inc., USA; Asdigha, Mehran, Charles River Analytics, Inc., USA; May 1996; 91p; In English

Contract(s)/Grant(s): MDA903-93-C-0132

Report No.(s): AD-A317174; R-92351; ARI-CR-96-04; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Army Research Institute (ARI) has developed and demonstrated the UH-1 Training Research Simulator (TRS), and shown it to be effective in providing low-cost, effective simulator-based basic training of initial-entry rotary wing (IERW) maneuvers. The system integrates technologies of distributed computational processing and computer image generators in a configura-

tion that has the potential for minimizing dependence on a dedicated instructor pilot. Six empirical studies have demonstrated the system's effectiveness in delivering positive transfer-of-training to the UH-1 helicopter, and further studies are planned to expand the evaluation effort's scope. A need has existed, however, to improve the instructional portions of the system by incorporating instructor pilot (IP) domain knowledge, and by providing the student pilot (SP) with appropriate tutorial feedback regarding proficiency progress. by doing so significant savings in IP hours could be realized to complement the savings already achieved through the low-cost hardware configuration. of perhaps greater significance was the potential of demonstrating how intelligent tutoring systems (ITSs) could be hybridized with flight training simulators to support the development of a new generation of low-cost intelligent flight trainers (IFTs). The potential thus existed far beyond the UH-1 TRS, and may have significant impact on several other existing and planned flight trainers.
DTIC
UH-1 Helicopter; Training Simulators; Rotary Wings; Image Processing; Flight Training

19970019633 National Aerospace Lab., Tokyo, Japan
Pressure Control Simulations of Ventilated Adaptive Walls
Nakamura, Masayoshi, National Aerospace Lab., Japan; Kuwano, Naoaki, National Aerospace Lab., Japan; Jun. 1996; ISSN 0389-4010; 16p; In Japanese
Report No.(s): NAL-TR-1295; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because aerodynamic interference between an airfoil model and wind-tunnel walls cannot be avoided, the concept of an adaptive-wall to reduce the previous interferences has been considered. This paper presents numerical simulations of pressure control at a ventilated adaptive wall for a two-dimensional wind tunnel. Numerical inner and outer flows of the wind-tunnel are calculated simultaneously and independently on the basis of Euler equations using a finite difference method in the Cartesian grid. The concept of an adaptive wall requires that the inner flow match the outer flow at control surfaces. This requirement is satisfied by matching the flow direction at the control surfaces. Numerical adaptive wall wind tunnel tests of the NACA0012 airfoil are being performed to demonstrate the possible applications of adaptive wall control. Several calculated results of airfoil abilities in the numerical wind tunnel are compared with experimental and other calculated results.
Author
Wind Tunnel Walls; Finite Difference Theory; Airfoils; Control Simulation; Aerodynamic Interference; Wall Flow

19970019692 NASA Ames Research Center, Moffett Field, CA USA
Development of an Apparatus for Wind Tunnel Dynamic Experiments at High-alpha
Pedreiro, Nelson, Stanford Univ., USA; Feb. 1997; 128p; In English; In English
Contract(s)/Grant(s): NCC2-55
Report No.(s): NASA-CR-203713; NAS 1.26:203713; JIAA-TR-119; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A unique experimental apparatus that allows a wind tunnel model two degrees of freedom has been designed and built. The apparatus was developed to investigate the use of new methods to augment aircraft control in the high angle of attack regime. The model support system provides a platform in which the roll-yaw coupling at high angles of attack can be studied in a controlled environment. Active cancellation of external effects is used to provide a system in which the dynamics are dominated by the aerodynamic loads acting on the wind tunnel model.
Author
Wind Tunnel Tests; Support Systems; Degrees of Freedom; Angle of Attack; Aerodynamic Loads; Aircraft Control

19970020433 Institute for Human Factors TNO, Soesterberg, Netherlands
Perceptual-Motor Aspects of Distributed Interactive Simulation (DIS) ***Final Report Perceptief-motorische aspecten van Distributed Interactive Simulation (DIS)***
deVries, S. C., Institute for Human Factors TNO, Netherlands; Padmos, P., Institute for Human Factors TNO, Netherlands; Apr. 15, 1997; 24p; In English
Contract(s)/Grant(s): A96/KL/354
Report No.(s): TD97-0190; TM-97-A028; Copyright; Avail: Issuing Activity (TNO, Human Factors Research Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands), Hardcopy, Microfiche

Distributed Interactive Simulation (DIS) is both the name of a technique and a communications protocol. Simulators complying with the DIS standards are able to share the same simulated space and interact with each other, and in this way enlarge the field of applications in which they can be employed. The ongoing development of DIS has been lead primarily by technical questions and may therefore contain unexplored human factors issues. This report attempts to identify such issues through a survey

of the literature and indicates areas which may need additional research. One problem area is that of the simulator architecture differences. Unequal simulator capabilities may lead to unfair play between participants. This is mainly a technical challenge although human factors research on selective handicapping might also provide a solution to this problem. Implementing selective handicapping schemes may not always be possible. Nevertheless, a large human factors research area remains in identifying relevant architecture differences and quantifying their effect. A second problem area is related to simulator networking. Positional uncertainty due to low update rates and delays results from the connection of simulators that are sometimes widely dispersed. A useful subdivision of delays is in intra-simulator delay and inter-simulator delay. There has been a substantial amount of research on intra-simulator delay, results of which have been applied to specify maximum allowable inter-simulator delay. However, inter-simulator delays differ fundamentally from intra-simulator delays and it is therefore important that research on the effects of inter-simulator delays commences, the more so as one model simulation reported in the literature suggests non-trivial interactions between intra- and inter-simulation delays.
Author
Distributed Interactive Simulation; Protocol (Computers); Networks

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19970019974 Alenia Spazio S.p.A., Turin, Italy
Launch Vibroacoustics Simulation and Validation of Transmitting Antennas of Telecommunications Satellites
Fornesi, M., Alenia Spazio S.p.A., Italy; Trittoni, L., Alenia Spazio S.p.A., Italy; Marucchi-Chierro, P. C., Alenia Spazio S.p.A., Italy; Milano, M., Alenia Spazio S.p.A., Italy; Nineteenth Space Simulation Conference Cost Effective Testing for the 21st Century; Jan. 1997, pp. 161; In English; Also announced as 19970019961; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

Spacecraft structures during launch phase are submitted to heavy acoustic excitation mainly generated by the engines and the aerodynamic forces over the vehicle. Since satellite dimensions are getting larger, as well as structures are getting lighter, sensitivity to acoustic environment increases and the vibration levels become critical, especially for large panels with small thickness. A tipology of substructures which can be included in this category are transmitting antennas of telecommunications satellites. The activity reported in the present work concerns the vibroacoustic analysis performed on the HOTBIRD 3 antenna, considering launch noise excitation and covering the complete frequency range related to the acoustic spectrum. In the low frequency field, a deterministic approach, based on FEM method, has been followed. The high number of d.o.f. of the model and the wide extension in frequency of the acoustic load require the choice of a limited number of load cases that could be used to reproduce the excitation. In the high frequency field, a statistical approach, based on Statistical Energy Analysis (SEA), has been employed; this method considers the effect of many, closely spaced modes, simultaneously active, and is therefore particularly suited to treat high modal density problems. Due to the difficulty to accurately evaluate both damping coefficient and joint acceptance, it is opportune that a turning of the mathematical model is performed on the basis of test experiences conducted an analogous structures. In this study, this activity of correlation has been conducted on HOTBIRD 3 antenna. From the comparison between acceleration levels analytically evaluated and experimentally measured, the effectiveness of the analytical approach chosen to perform the vibroacoustic analysis of the antenna in the whole requested frequency range (typically for octave bands with center frequency 31.5 Hz up to 8 KHz) is pointed out. In particular, the agreement between the results obtained with deterministic and statistical methods has to be highlighted.
Author
Satellite Antennas; Telecommunication; Acoustic Excitation; Vibrational Stress; Spacecraft Structures; Loads (Forces); Aerodynamic Forces

19970019995 Department of Agriculture, Beltsville, MD USA
The GSFC 6-Axis Hydraulic Shaker System
Hershfeld, Donald, Department of Agriculture, USA; Nineteenth Space Simulation Conference Cost Effective Testing for the 21st Century; Jan. 1997, pp. 371; In English; Also announced as 19970019961; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche; Abstract Only; Abstract Only

A six degree of freedom, hydraulic shaker system has been installed in the vibration laboratory at Goddard Space Flight Center. This facility will be used to support research and development projects to investigate the feasibility of direct measurement of the multi-degree of freedom interface impedance matrix, the ability to control a multi-degree of freedom vibration environment and the effect of multi-degree of freedom testing on the response of aerospace structures. This paper will present the design characteristics of the shaker and demonstrate its operational performance.
Author
Aircraft Structures; Degrees of Freedom; Hydraulic Equipment; Vibration Effects

19970020127 Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA
New Developments Abroad in Space Flight Control Technology
Chen, Zu-Gui; CASC International Technical Exchange Reports; Oct. 01, 1996; Volume 2, No. 5, pp. 140-149; In English; Translated into English by Leo Kanner Associates
Contract(s)/Grant(s): F33657-88-D-2188
Report No.(s): AD-A316754; NAIC-ID(RS)T-0365-96; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This article introduces achievements over the past few years and the direction of developments in the major fields involving space control technology at the 12th Conference on Space Automated Control. It emphasizes a description of ground testing technology of space vehicle GNC systems, space vehicle autonomous control technology, space robot technology and mechanical arm technology as well as flexible space vehicle control technology and GPS navigation technology. Finally it concludes with an introduction of experiences and lessons of several foreign space vehicles and recommendations for China's space platforms and modularizing mode control systems.
DTIC
Automatic Control; Aerospace Engineering; Space Flight; Flight Control; Control Systems Design; Robot Arms; Spacecraft Control; Conferences

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19970019535 Armstrong Lab., Brooks AFB, TX USA
Technical Evaluation of Moving C-130 Engine Compressor Wash Operations Indoor Washrack, Building 228, Little Rock Air Force Base, Arkansas *Final Report, 23 - 27 Jan. 1995*
Schmidt, Franz J., Armstrong Lab., USA; Hemenway, Doris A., Armstrong Lab., USA; Davis, Robert P., Armstrong Lab., USA; Oct. 1996; 35p; In English
Report No.(s): AD-A317152; AL/OE-TR-1996-0129; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Personnel from the Armstrong Laboratory Water Quality Branch conducted Wastewater Characterization on the wastewater from a C-130 Engine Compressor Wash Ope ration at Little Rock AFB, Arkansas, 23-27 Jan 95. Based on the Cadmium and Nickel Mass Balance Models, the scope of the survey was to compare the models with the actual amount of cadmium and nickel in the engine compressor washwater from the point where the washwater fell from the C-130 aircraft to Little Rock AFB's wastewater discharge point. The combined results of the phased investigation led to our recommendations that the base could conduct compressor washes on up to two or three aircraft per day without pretreatment. We recommended that the base carefully monitor and maintain the oil/water separator at Facility 228 as long as compressor washes would be conducted there, to ensure that non-compliance would not result from cadmium in the separator from past operations being released into the sanitary sewer system in subsequent operations, resulting in a slug of heavy metals that could cause a violation of pretreatment agreement limits. Additionally, we recommended that if compressor washes were to be conducted for a long time period, the base should consider an industrial wastewater pretreatment system for heavy metals generated from the operations.
DTIC
Evaluation; Compressors; Performance Tests; Water Quality; C-130 Aircraft; Engines

19970019668 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
3-D Composites in Primary Aircraft Structure Joints
Bersuch, Larry, Lockheed Martin Tactical Aircraft Systems, USA; Hunten, Keith, Lockheed Martin Tactical Aircraft Systems, USA; Baron, Bill, Wright Lab., USA; Tuss, James, Wright Lab., USA; Jan. 1997; 10p; In English; Also announced as

19970019652; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Three-dimensional woven and braided inserts and preforms, when cocured into primary wing and fuselage laminate structure, offer reduced weight, increased performance, lower costs, and improved damage tolerance and ballistic survivability for future aircraft. to achieve these benefits, three-dimensional (3-D) weaving and braiding technologies must be characterized through the development of design criteria, design methods, structural concepts, and manufacturing processes. In addition to 3-D weaving and braiding, z-direction reinforcement can be achieved through in-process fiber insertion with processes such as z-spiking, stitching, and short fiber additions to adhesives. Innovative applications of these technologies, combined with net shape curing processes such as resin transfer molding (RTM), electron beam cure, diaphragm forming, fiber placement, and cocuring, will result in the elimination of machined metal load fittings, fasteners, and reduction in weight at composite joints on future aircraft. Wing applications for 3-D composites would be at the intersection of spars and ribs and in the radius area between spars/ribs and the lower skin of a cocured wing assembly. In fuselage structure, 3-D composites eliminate the need for machined fittings and fasteners at concentrated load joints such as those at inlet duct, weapons bay, gun-trough, and fuel floor intersections with bulkheads/frames. This paper is directed at design for manufacturing of 3-D composite structures to best exploit the structural properties that they exhibit.

Author

Aircraft Structures; Composite Materials; Composite Structures; Curing; Fuselages; Laminates; Resin Transfer Molding; Wings; Three Dimensional Composites; Structural Design

19970019669 Aztex, Inc., Waltham, MA USA

Z-Fiber Technology and Products for Enhancing Composite Design

Freitas, G., Aztex, Inc., USA; Fusco, T., Aztex, Inc., USA; Campbell, T., Foster-Miller Associates, Inc., USA; Harris, J., Foster-Miller Associates, Inc., USA; Rosenberg, S., Foster-Miller Associates, Inc., USA; Jan. 1997; 8p; In English; Also announced as 19970019652; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Z-Fiber(TM) technology uses small, solid, cylindrical pins to greatly enhance the performance of composite structures. These pins, typically 0.25 to 0.50 mm in diameter, can be used for many structural applications. Z-Fibers, either composite or metal, are inserted through the thickness of a composite laminate to increase out-of-plane strength, damage resistance, and through thickness thermal conductivity. Z-Fiber is also used for structural joints and can be designed to be the structural network of the core material in an extremely weight and cost efficient sandwich structure. Z-Fiber technology has been under development for over ten years. The growth of this technology, originally developed by Foster-Miller Inc., has begun to move at a very accelerated rate under Aztex Inc. during the past two years. Despite this extended development period, the revolutionary advances in the performance of composite structures made possible by this technology are only now becoming fully apparent. When used at the conceptual stage of aircraft design, when the overall structural arrangement is being formulated, Z-Fiber technology can completely change the current design approaches. This paper presents a general overview of Z-Fiber technology and products and focuses on the work to date to form structural joints. The paper demonstrates, even at this early stage of development, Z-Fiber's capability to outperform fasteners and significantly increase the static survivability of composites.

Author

Composite Structures; Aircraft Design; Thermal Conductivity; Structural Design; Sandwich Structures; Laminates

19970019924 NASA Lewis Research Center, Cleveland, OH USA

Internal Radiation Effects in Zirconia Thermal Barrier Coatings

Siegel, Robert, NASA Lewis Research Center, USA; Journal of Thermophysics and Heat Transfer; Jun. 09, 1996; Volume 10, No. 4, pp. 707-709; In English

Report No.(s): NASA-TM-112842; NAS 1.15:112842; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Using thermal barrier coatings on combustor liners, turbine vanes, and rotating blades is important for reducing metal temperatures in current and advanced aircraft engines. Zirconia is a common coating material, and it is partially transparent to thermal radiation. Radiation becomes more significant as temperatures are raised for higher efficiency in advanced engines. Calculations are often made with radiation effects neglected inside the coating. The effect of radiation is illustrated here, where an analytical procedure is provided by using the two-flux method for the radiative contribution. A detailed study was made of ceramic thermal barrier coatings for diesel engines, and a two-flux analysis was developed for radiation in semitransparent multilayer composites. These efforts provide the basis for the present analysis where illustrative solutions are obtained for typical conditions in an aircraft engine. The formulation and solution of the exact spectral radiative transfer equations including large

scattering, as is characteristic of zirconia, are rather complicated. The two-flux method is used here to provide a simplified method.
Derived from text
Thermal Control Coatings; Aircraft Engines; Radiative Transfer; Thermal Radiation; Zirconium; Differential Equations; Temperature Distribution; Runge-Kutta Method

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970019491 NASA Langley Research Center, Hampton, VA USA
Application of Interface Technology in Nonlinear Analysis of a Stitched/RFI Composite Wing Stub Box
Wang, John T., NASA Langley Research Center, USA; Ransom, Jonathan B., NASA Langley Research Center, USA; Apr. 1997; 16p; In English; 38th; Structures, Structural Dynamics, and Materials, 7-11 Apr. 1997, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA-TM-112837; NAS 1.15:112837; AIAA Paper 97-1190; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A recently developed interface technology was successfully employed in the geometrically nonlinear analysis of a full-scale stitched/RFI composite wing box loaded in bending. The technology allows mismatched finite element models to be joined in a variationally consistent manner and reduces the modeling complexity by eliminating transition meshing. In the analysis, local finite element models of nonlinearly deformed wide bays of the wing box are refined without the need for transition meshing to the surrounding coarse mesh. The COMET-AR finite element code, which has the interface technology capability, was used to perform the analyses. The COMET-AR analysis is compared to both a NASTRAN analysis and to experimental data. The interface technology solution is shown to be in good agreement with both. The viability of interface technology for coupled global/local analysis of large scale aircraft structures is demonstrated.
Author
Wings; Composite Structures; Bending; Finite Element Method; Aircraft Structures; Structural Analysis

19970019521 Wright Lab., Wright-Patterson AFB, OH USA
An Overview of Rotating Stall and Surge Control for Axial Flow Compressors
Gu, Guo-Xiang, Louisiana State Univ., USA; Banda, Siva, Wright Lab., USA; Sparks, Andy, Wright Lab., USA; Nov. 1995; 19p; In English
Report No.(s): AD-A320482; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modeling and control for axial flow compression systems have received great attention in recent years. The objectives are to suppress rotating stall and surge, to extend the stable operating range of the compressor system, and/or to enlarge domains of attraction of stable equilibria using feedback control methods. The success of this research field will significantly improve compressor efficiency and thus future aeroengine performance. This paper surveys the research literature and summarizes the major developments in this active research field, focusing on the modeling and control perspectives for rotating stall and surge in axial flow compressors.
DTIC
Rotating Stalls; Surges; Axial Flow; Feedback Control; Research; Turbocompressors; Models

19970019596 NASA Langley Research Center, Hampton, VA USA
Response of Composite Panels with Stiffness Gradients Due to Stiffener Terminations and Cutouts
Ambur, Damodar R., NASA Langley Research Center, USA; Starnes, James H., Jr., NASA Langley Research Center, USA; Davila, Carlos G., NASA Langley Research Center, USA; Phillips, Erik A., Virginia Univ., USA; 1997; 14p; In English; 38th; Structures, Structural Dynamics and Materials, 7-10 Apr. 1997, Kissimmee, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA-TM-112845; NAS 1.15:112845; AIAA Paper 97-1368; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of an analytical and experimental study of stiffened graphite-epoxy compression panels with terminated stiffeners are presented. The local stress gradients at the stiffener termination location are determined by finite element analysis. Three stiffener termination concepts are evaluated by analysis to determine the stiffener and skin laminate parameters that affect the panel response and failure. The effects of changing local skin laminate definitions, skin reinforcement details, and stiffener termination details on local stress gradients and load-path eccentricities are discussed. Analytical and test results are presented for panels with one terminated stiffener and for panels with one terminated stiffener and two unterminated stiffeners. The effects of a cutout in the skin of a panel with a terminated stiffener is also evaluated to determine the interaction between the stress gradients in the panel due to the cutout and those due to the terminated stiffener. The results of the study indicate that the critical failure modes of the panels initiate at the skin-stiffener interface near the end of the terminated stiffener.
Author
Composite Structures; Aircraft Structures; Graphite-Epoxy Composites; Failure Modes; Finite Element Method; Stiffening

19970019675 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany
Quality Assurance and Certification Procedures for Bonded Joints in On-Aircraft Scenarios
Maier, A., Daimler-Benz Aerospace A.G., Germany; Gunther, G., Daimler-Benz Aerospace A.G., Germany; Jan. 1997; 10p; In English; Also announced as 19970019652; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As the repair of primary composite aircraft structures using composite materials has become a matter of 'world wide interest and activity', the requirement of certification methods and engineering standards for composite repairs have become evident. Bonded joints for principal load transfer within the structure have to run through an extensive certification/qualification procedure during development phase and are subject to rigorous quality control during the original component manufacturing. However, within typical 'On-Aircraft' repair scenarios bonding procedures and manufacturing conditions are in almost every technical aspect different from original processes and require therefore more extensive verification. Methods to certify repair design, repair procedures, repair methodology and quality control depend on specific repair levels (i.e SRM, Engineering Disposition, ABDR) and are yet standardised. The paper describes DASA's current approach to certify bonded repairs for damages which require 'Engineering Disposition' for 'On-Aircraft' application.
Author
Bonded Joints; Aircraft Structures; Composite Structures; Aircraft Maintenance; Quality Control

19970019737 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Signal Processing Methods for Gearbox Fault Detection
Rofe, Simon, Defence Science and Technology Organisation, Australia; Feb. 1997; 43p; In English
Report No.(s): DSTO-TR-0476; AR-010-104; Copyright; Avail: Issuing Activity (Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne Vic 3001, Australia), Hardcopy, Microfiche

Methods of accounting for load variation in vibration signals from helicopter transmission systems are presented. These methods are based on autoregressive moving-average (ARMA) models, and several ARMA parameter estimation schemes are presented. Simulations of load variation are carried out, and a prediction error filter, based on the ARMA models, is used to generate a residual signal. Fault indices extracted from the residential signal are used to indicate the presence or absence of a fault. The results of the simulations suggest that this method of fault detection is able to detect both general and local fault conditions.
Author
Signal Processing; Fault Detection; Gears; Helicopter Propeller Drive; Vibration Effects; Simulation

19970019893 Utah Univ., Dept. of Mechanical Engineering, Salt Lake City, UT USA
The Role of Fretting Fatigue on Aircraft Rivet Hole Cracking ***Final Report***
Heoppner, David W., Utah Univ., USA; Elliot, Charles D., III, Utah Univ., USA; Moesser, Mark W., Utah Univ., USA; Oct. 1996; 80p; In English
Report No.(s): AD-A319284; 93-G-068; DOT/FAA/AR-96/10; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This is the final report on the Federal Aviation Administration (FAA) Grant No. 93-G-068 Program conducted by the Quality and Integrity Design Engineering Center (QIDEC), Department of Mechanical Engineering, University of Utah. The program is entitled The Role of Fretting Corrosion and Fretting Fatigue on Aircraft Rivet Hole Cracking. A lap joint panel removed from an aircraft used in service was investigated for evidence of fretting induced cracking in and adjacent to the rivet holes. Cracks were found in all of the rivet holes that were inspected. A sensitivity study was conducted to determine the effects of fretting on the fatigue lives of 2024-T3 clad sheet aluminum alloy riveted joint specimens prepared with either FV or CE rivets using either C-squeeze riveting or a rivet gun with bucking bar riveting procedures. A method was developed to predict coefficient of friction characteristics within a fretted contact during the nucleation of a crack. A finite element method was used to calculate the state

of stress at CE rivet locations where fretting-nucleated cracks were observed. The primary conclusion of this grant program is that fretting in riveted joints is a potentially major cause of crack nucleation in aircraft skin structure.
DTIC
Finite Element Method; Aircraft Structures; Aluminum Alloys; Coefficient of Friction; Cracks; Fretting; Fretting Corrosion; Rivets

19970019921 Defence Science and Technology Organisation, Airframes and Engines Div., Canberra, Australia
Experimental Results of Cruciform Specimens Under Biaxial Elastic-Plastic Loading
Wang, C. H., Defence Science and Technology Organisation, Australia; Heller, M., Defence Science and Technology Organisation, Australia; Aug. 1996; 55p; In English
Report No.(s): AD-A319317; DSTO-TR-0399; DODA-AR-009-808; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Biaxial experiments have been conducted using cruciform specimens to generate elastic-plastic material deformation data. Such data is required to validate a multiaxial constitutive model which has been implemented in finite element analysis codes at AMRL. The elastic-plastic data have been obtained for two aircraft metallic materials namely: 7050 aluminium alloy and D6AC high strength steel. In this work some of the deficiencies in the existing biaxial test system at AMRL have been rectified, including the provision for strain control testing. It has been shown that for this type of work, a new specimen design is needed to allow a wider range of biaxial stress conditions to be investigated, and a suitable design is given herein. Furthermore, as an alternative to incremental plasticity models, a simple closed-form, integral solution has been developed and is presented for proportional, cyclic loading. Using this integral solution, good agreement between experimental results and the theoretical predictions has been obtained.

19970019941 Hughes Technical Center, Atlantic City International Airport, NJ USA
A Field Evaluation of Data Link Flight Information Services for General Aviation Pilots ***Final Report***
Talotta, Nicholas J., National Technical Information Service, USA; Feb. 1997; 78p; In English
Report No.(s): DOT/FAA/CT-97-3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report documents a field study of Data Link Flight Information Services (FIS) designed for use by General Aviation (GA) pilots. The traffic information and weather services were developed by MIT Lincoln Laboratory under Federal Aviation Administration (FAA) sponsorship. The report is an independent assessment of the field study conducted by the Data Link Branch of the FAA William J. Hughes Technical Center.
Derived from text
Data Links; Information Systems; Traffic; Evaluation; General Aviation Aircraft
DTIC
High Strength Steels; Aluminum Alloys; Axial Loads; Deformation; Finite Element Method; Elastic Properties; Cruciform Wings; Structural Analysis; Axial Stress

19970019945 Iowa State Univ. of Science and Technology, Center for Nondestructive Evaluation, Ames, IA USA
Nondestructive Detection and Characterization of Corrosion in Aircraft ***Final Report, 1 Jul. 1993 - 30 Sep. 1996***
Rose, James H., Iowa State Univ. of Science and Technology, USA; Moulder, John C., Iowa State Univ. of Science and Technology, USA; Gray, Joseph N., Iowa State Univ. of Science and Technology, USA; Nov. 1996; 9p; In English
Contract(s)/Grant(s): F49620-93-I-0439; AF Proj. 3484
Report No.(s): AD-A318667; AFOSR-TR-96-0569; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have developed a fully characterized pulsed eddy current (PEC) instrument to detect and characterize second-layer corrosion in aircraft skin. In the first year, we developed the theory needed to accurately model the response of the PEC instrument measured on a variety of calibration specimens. In the second year, we made experimental measurements on a number of realistic samples including a corrosion test panel provided by Boeing corporation. In addition, inverse methods were developed for estimating the location and amount of hidden corrosion. In the third year, the inversion methods were fully incorporated in the PEC instrument. New methods were developed: (1) for calculating the response due to pitting corrosion; and (2) for removing interfering signals from fasteners and other structures. The experimental effort in the third year focused on technology transfer. The instrument was a highly successful participant in the Air Force blind trials for corrosion detection and characterization.
DTIC
Corrosion Tests; Eddy Currents; Nondestructive Tests; Aircraft Structures; Skin (Structural Member)

19970019975 NASA Goddard Space Flight Center, Greenbelt, MD USA

Acceleration Testing: A Better, Faster, Cheaper Alternative for Strength Qualification Testing

Mattiello, Carmine F., NASA Goddard Space Flight Center, USA; Nineteenth Space Simulation Conference Cost Effective Testing for the 21st Century; Jan. 1997, pp. 163-171; In English; Also announced as 19970019961; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper addresses the advantages of utilizing a centrifuge test over the conventional static load test methods to structurally qualify aerospace structures. Three recent test cases are reviewed and used as examples to highlight these benefits. In addition, the overall capability of Goddard's High Capacity Centrifuge (HCC) is outlined along with some unique features that were designed specifically to reduce costs, test turn around time, and increase test item safety.

Author

Acceleration Measurement; Aircraft Structures; Performance Tests; Cost Reduction; Load Tests

19970020325 Systems Research Labs., Inc., Dayton, OH USA

Advanced Laser Diagnostics Development and Application ***Final Report, 1 Jun. 1990 - 31 Mar. 1996***

Grosjean, D. F., Systems Research Labs., Inc., USA; Jun. 1996; 889p; In English; Original contains color plates

Contract(s)/Grant(s): F33615-90-C-2033; AF Proj. 3048

Report No.(s): AD-A319372; WL-TR-96-2081; SRL-TR-5579; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

Experimental and numerical investigations on gas-turbine combustion processes and jet-fuel thermal stability were undertaken. Advanced laser-based diagnostic techniques were developed and applied to the experimental study of combustion processes (jet diffusion flames and research combustors) and jet-fuel thermal-stability processes (autoxidation, global chemistry, and fuel-additive effects). In addition, numerical computational fluid dynamics with chemistry (CFDC) models detailing both the fluid dynamics and chemistry were developed to simulate realistic environments. The development, calibration, and evaluation of the numerical models employing fundamental combustion and fuel experiments was the ultimate goal of this research program.

DTIC

Thermal Stability; Jet Engine Fuels; Computational Fluid Dynamics; Laser Induced Fluorescence; Diffusion Flames; Premixed Flames; Laser Doppler Velocimeters; Particle Image Velocimetry; Combustion

19970020341 Army Aeromedical Research Lab., Fort Rucker, AL USA

RAH-66 Comanche Health Hazard and Performance Issues for the Helmet Integrated Display and Sighting System ***Final Report***

Rash, Clarence E., Army Aeromedical Research Lab., USA; Mozo, Ben T., Army Aeromedical Research Lab., USA; McEntire, B. J., Army Aeromedical Research Lab., USA; Licina, Joseph R., Army Aeromedical Research Lab., USA; Nov. 1996; 48p; In English

Contract(s)/Grant(s): DA Proj. 3M1-62787-A8-79

Report No.(s): AD-A319150; USAARL-97-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The helmet integrated and display sighting system (HIDSS) is a combination of a protective helmet, helmet mounted display (HMD), and helmet mounted sighting system. It is planned for use in the Army's next generation reconnaissance/attack helicopter, the RAH-66 Comanche. In 1986 and 1988, USAARL developed and published guidelines for addressing potential health hazard issues with the HIDSS. The most recent version of these guidelines was USAARL LR 88-4-21-1O, 'Revision for the health hazard issues in the MIDSS.' This paper is a further revision of these issues. In addition to recommendations provided for performance in the areas of biodynamics, optics/vision, and acoustics, a number of safety and training issues are discussed.

DTIC

Helmet Mounted Displays; Helicopters; Biodynamics; Aircraft Equipment; Reconnaissance Aircraft; H-60 Helicopter; Acoustics; Helmets

19970020392 NASA Dryden Flight Research Center, Edwards, CA USA

Finite-Element Analysis of a Mach-8 Flight Test Article Using Nonlinear Contact Elements

Richards, W. Lance, NASA Dryden Flight Research Center, USA; Jun. 1997; 20p; In English; Contact Mechanics, 1-3 Jul. 1997, Madrid, Spain

Contract(s)/Grant(s): RTOP 529-60-24

Report No.(s): NASA-TM-4796; H-2169; NAS 1.15:4796; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A flight test article, called a glove, is required for a Mach-8 boundary-layer experiment to be conducted on a flight mission of the air-launched Pegasus(reg) space booster. The glove is required to provide a smooth, three-dimensional, structurally stable, aerodynamic surface and includes instrumentation to determine when and where boundary-layer transition occurs during the hy-

personic flight trajectory. A restraint mechanism has been invented to attach the glove to the wing of the space booster. The restraint mechanism securely attaches the glove to the wing in directions normal to the wing/glove interface surface, but allows the glove to thermally expand and contract to alleviate stresses in directions parallel to the interface surface. A finite-element analysis has been performed using nonlinear contact elements to model the complex behavior of the sliding restraint mechanism. This paper provides an overview of the glove design and presents details of the analysis that were essential to demonstrate the flight worthiness of the wing-glove test article. Results show that all glove components are well within the allowable stress and deformation requirements to satisfy the objectives of the flight research experiment.
Author
Finite Element Method; Boundary Layer Transition; Hypersonic Speed; Structural Design; Leading Edges; Research; Aerodynamics

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970020240 Naval Air Warfare Center, Research and Technology Div., China Lake, CA USA
CFC-Free Technology for Missile Electronics
Fischer, J., Naval Air Warfare Center, USA; Smith, J., Naval Air Warfare Center, USA; Nickell, R., Naval Air Warfare Center, USA; Merwin, L., Naval Air Warfare Center, USA; Nissan, R., Naval Air Warfare Center, USA; Environmentally Sound Processing Technology: JANNAF Safety and Environmental Protection Subcommittee and Propellant Development and Characterization Subcommittee Joint Workshop; Jul. 1995, pp. 51-58; In English; Also announced as 19970020234; No Copyright; Avail: Issuing Activity (CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC), Hardcopy, Microfiche

Ozone depleting substances (ODS) have been employed in the fabrication and maintenance of missile electronics/avionics because of their cleaning efficiency and low toxicity CFC-113 and methyl chloroform, the most widely used solvents, must be replaced by 1 January 1996 in all electronics applications of missile technology. Because of the high sensitivity of electronics to post soldering and processing residues caution must be exercised when developing or choosing replacement materials. This paper describes three alternatives for electronics fabrication and cleaning: (1) use of water soluble flux and aqueous cleaning, (2) no-clean or low residue soldering technology, and (3) semi-aqueous solvent cleaning. The scope and limitations of these three options will be described.
Author
Soldering; Solvents; Aqueous Solutions; Electronic Equipment; Cleaning; Fabrication; Environment Protection; Avionics

19970020242 Naval Weapons Station, Weapons Quality Engineering Center, Concord, CA USA
Alternative CFC-Free Cleaning and Degreasing Process for TF-34 and T-56 Engine Components
Tse, Kelvin, Naval Weapons Station, USA; Smith, William, Defense General Supply Center, USA; Tripathi, Hem, Defense General Supply Center, USA; Environmentally Sound Processing Technology: JANNAF Safety and Environmental Protection Subcommittee and Propellant Development and Characterization Subcommittee Joint Workshop; Jul. 1995, pp. 67-79; In English; Also announced as 19970020234; No Copyright; Avail: Issuing Activity (CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC), Hardcopy, Microfiche

Although 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113) is an effective cleaner for the vapor degreasing of TF-34 and T-56 aircraft engine components, it is ozone depleting and will be phased-out in December 31, 1995. In order to continue to clean engine components prior to rework or electroplating, the end users of CFC-113 must find new environmentally safe cleaners and degreasing methods to replace the CFC-113 vapor degreasing process. This paper summarizes some work being done on finding alternative cleaners for the replacement of CFC-113 vapor degreasers and provides a few practical screening steps that other end users can use to modify or replace their CFC-113 cleaning and degreasing processes. The evaluation presented in this paper will show that in order to find acceptable replacement cleaners for the degreasing process, numerous commercially available cleaners were considered. These chemicals were evaluated based on a cleaner selection criteria. These chemicals were tested for the degreasing efficiency, potential for aircraft component corrosion, metal surface particulate cleanliness, and aircraft component material compatibility. The results of these tests revealed that several cleaners can effectively replace the CFC-113 vapor degreasing of TF-34

and T-56 engine components. These new cleaners are recommended to be used with immersion tanks or high pressure spray washers to achieve the best cleaning results.
Author
Cleaning; Tf-34 Engine; T-56 Engine; Engine Parts; Cleaners; Corrosion Tests; Cost Analysis; Solvents; Performance Tests

19970020332 Armstrong Lab., Environics Directorate, Tyndall AFB, FL USA
FIP: A Pattern Recognition Program for Fuel Spill Identification ***Final Report, Aug. 1993 - Aug 1995***
Faruque, A., Armstrong Lab., USA; Lavine, B. K., Armstrong Lab., USA; Mayfield, Howard T, Armstrong Lab., USA; May 1996; 35p; In English
Report No.(s): AD-A317141; AL/EQ-TR-1996-0007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Gas Chromatography and pattern recognition methods (GC-PR) constitute a powerful tool for investigating complex environmental problems e.g., realistically analyze large chromatographic data sets and to seek meaningful relationships between chemical constitution and source variables. Recently, out laboratory has investigated the potential of GC-PR as a method for typing fields in order to directly relate a spill sample to its source. A graphic user interface (GUI) based interactive software called FIP (fuel identification program) has been developed. The development of this software system takes advantage of the high performance computational and visualization routines of the MATLAB programming environment. Both neural networks and statistical pattern recognition techniques are implemented. FIP employs covariance stabilization of the data to ensure correct classification of the gas chromatograms of weathered and un-weathered jet fuels.
DTIC
Gas Chromatography; Computer Programs; Pattern Recognition; Jet Engine Fuels; Spilling; Graphical User Interface

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19970019611 Armstrong Lab., Wright-Patterson AFB, OH USA
Optimal Personnel Assignment: An Application to Air Force Pilots ***Interim Report, Feb. - Dec. 1993***
Siem, Frederick M., Armstrong Lab., USA; Alley, William E., Armstrong Lab., USA; Mar. 1996; 17p; In English
Contract(s)/Grant(s): AF Proj. 7719; AF Proj. 1123
Report No.(s): AD-A316975; AL/HR-TP-1996-0003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study was conducted to examine the potential utility of optimally assigning Air Force pilots to training tracks without benefit of actual training outcomes. The resulting assignment solution indicated that (a) there was sufficient agreement among pilots to form coherent selection policies that differed across types of aircraft, and (b) mean predicted performance could be improved about one-third standard deviation relative to random allocation. Follow-up research is discussed.
DTIC
Aircraft Pilots; Flight Crews

19970020223 Armstrong Lab., Human Resources Directorate, Mesa, AZ USA
The Future of Selective Fidelity in Training Devices ***Final Report, Jun. 1994 - Nov. 1995***
Andrews, Dee H., Armstrong Lab., USA; Carroll, Lynn A., Armstrong Lab., USA; Bell, Herbert H., Armstrong Lab., USA; Educational Technology; Mar. 1996; Volume 6, No. 35, pp. 32-36; In English; 16th; Interservice/Industry Training Systems and Education, 28 Nov. - 1 Dec. 1994, Orlando, FL, USA
Contract(s)/Grant(s): AF Proj. 2743
Report No.(s): AD-A316902; AL/HR-TR-1995-0195; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since the inception of modern simulation, the designers and users of training devices have attempted to replicate as many physical and functional stimuli as possible in the training device. There are three primary impediments to this activity: our frequent inability to specify the kinds of stimuli that are required, our technological difficulty in replicating some stimuli, and the cost of replicating stimuli. The constraints cited above have led the training device community to develop the concept of selective fidelity, meaning that we have to be very selective about the stimuli that we choose to replicate. This report presents arguments that our definitions of selective fidelity now need to be altered to fit recent behavioral and engineering developments. Over the years, we have improved our ability through research and analysis to define the important stimuli. Also, our engineering capability to replicate formerly difficult stimuli has improved significantly. Finally, there have been dramatic decreases in the cost of providing high fidelity simulation. In this report, we discuss our belief that while the concept of selective fidelity will remain important to the

training device community, the definition of selective fidelity will be more focused on trainee learning requirements than on analytical and technological shortcomings.
DTIC
Human Factors Engineering; Flight Simulators; Training Devices; Flight Training

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970019605 Mei Technology Corp., San Antonio, TX USA
COACH: A Sample Training Application for the Integrated Maintenance Information System (IMIS) ***Interim Report, Jul. 1992 - Aug. 1994***
Wilson, Andrew S., Mei Technology Corp., USA; Walsh, William J., Mei Technology Corp., USA; Feb. 1996; 121p; In English
Contract(s)/Grant(s): F33615-91-D-0651; AF Proj. 1121
Report No.(s): AD-A316974; AL/HR-TR-1995-0203; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report summarizes activities conducted during early phases of a research project to evaluate use of the Integrated Maintenance Information System (IMIS) in aircraft maintenance training. Specifically, one IMIS component, the Portable Maintenance Aid (PMA), a job-aiding device used on the flightline, was studied to determine its potential application for training. Maintenance training embedded in the PMA can be useful if applied under the right conditions and circumstances, e.g., clearly distinguishing training from the real thing, and ensuring that simulated faults neither degrade weapon system performance nor personnel safety: In a formal school environment, IMIS provides the kind of diagnostic intelligence at-the-fingertip that can enable cognitive apprenticeship training to be effective. A demonstration program called COACH, a stand-alone application that can run on a PC or the PMA, was developed to illustrate how a training application could be implemented almost immediately on the PMA. Included in the appendix are sample screens that form a model for further development of an IMIS embedded training capability. Furthermore, the report describes how any training must interface with IMIS screens to make use of the inherent maintenance knowledge contained in IMIS.
DTIC
Aircraft Maintenance; Information Systems; Maintenance Training; Safety

19970019637 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
An Efficient Multiblock Method for Aerodynamic Analysis and Design on Distributed Memory Systems
Reuther, James, Research Inst. for Advanced Computer Science, USA; Alonso, Juan Jose, Stanford Univ., USA; Vassberg, John C., Douglas Aircraft Co., Inc., USA; Jameson, Antony, Stanford Univ., USA; Martinelli, Luigi, Princeton Univ., USA; Jan. 1997; 34p; In English; 13th; Computational Fluid Dynamics, Jun. 1997; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS2-96027; N00014-92-J-1796; F49620-95-I-0259
Report No.(s): NASA-CR-204485; NAS 1.26:204485; RIACS-TR-97-05; AIAA Paper 97-1893; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work presented in this paper describes the application of a multiblock gridding strategy to the solution of aerodynamic design optimization problems involving complex configurations. The design process is parallelized using the MPI (Message Passing Interface) Standard such that it can be efficiently run on a variety of distributed memory systems ranging from traditional parallel computers to networks of workstations. Substantial improvements to the parallel performance of the baseline method are presented, with particular attention to their impact on the scalability of the program as a function of the mesh size. Drag minimization calculations at a fixed coefficient of lift are presented for a business jet configuration that includes the wing, body, pylon, aft-mounted nacelle, and vertical and horizontal tails. An aerodynamic design optimization is performed with both the Euler and Reynolds Averaged Navier-Stokes (RANS) equations governing the flow solution and the results are compared. These sample calculations establish the feasibility of efficient aerodynamic optimization of complete aircraft configurations using the RANS equations as the flow model. There still exists, however, the need for detailed studies of the importance of a true viscous adjoint method which holds the promise of tackling the minimization of not only the wave and induced components of drag, but also the viscous drag.
Author
Navier-Stokes Equation; Parallel Computers; Aircraft Configurations; Transonic Flow; Distributed Processing; Computational Grids; Computational Fluid Dynamics; Aerodynamic Drag

19970020091 Stanford Univ., Stanford, CA USA

Training in Research and Construction of Secure Distributed Real-Time Systems ***Final Report***

Luckham, David C., Stanford Univ., USA; Oct. 1996; 5p; In English

Contract(s)/Grant(s): N00014-93-I-1216; N00014-92-J-1928; N00014-93-I-1335; AF-AFOSR-0354-91

Report No.(s): AD-A320352; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We had proposed to augment current ARPA, and AFOSR funded research and technology projects by supporting additional graduate students, one from ARPA and one from AFOSR and their computing equipment. These students were trained on these DoD research projects in the areas of design and implementation of specification and prototyping languages for system architecture. The students were trained in (1) specification and prototyping of architectures for avionics systems, simulation systems, and other time-critical systems, (2) methods of testing actual products for conformance to architectural standards, and (3) design and implementation of support tools for simulation and verification of such systems.

DTIC

Architecture (Computers); Avionics; Real Time Operation; Systems Simulation; Distributed Processing

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19970019601 NASA Langley Research Center, Hampton, VA USA

Optimizing an Actuator Array for the Control of Multi-Frequency Noise in Aircraft Interiors

Palumbo, D. L., NASA Langley Research Center, USA; Padula, S. L., NASA Langley Research Center, USA; 1997; 8p; In English; 3rd; Aeroacoustics, 12-14 May 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA-TM-112847; NAS 1.15:112847; AIAA Paper 97-1615; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Techniques developed for selecting an optimized actuator array for interior noise reduction at a single frequency are extended to the multi-frequency case. Transfer functions for 64 actuators were obtained at 5 frequencies from ground testing the rear section of a fully trimmed DC-9 fuselage. A single loudspeaker facing the left side of the aircraft was the primary source. A combinatorial search procedure (tabu search) was employed to find optimum actuator subsets of from 2 to 16 actuators. Noise reduction predictions derived from the transfer functions were used as a basis for evaluating actuator subsets during optimization. Results indicate that it is necessary to constrain actuator forces during optimization. Unconstrained optimizations selected actuators which require unrealistically large forces. Two methods of constraint are evaluated. It is shown that a fast, but approximate, method yields results equivalent to an accurate, but computationally expensive, method.

Author

Aircraft Noise; Aircraft Compartments; Noise Reduction; Actuators; Optimization; Position (Location)

19970019708 Pennsylvania State Univ., Sharon, PA USA

Computational Noise Study of a Supersonic Short Conical Plug-Nozzle Jet ***Final Report***

Das, Indu S., Pennsylvania State Univ., USA; Khavaran, Abbas, NYMA, Inc., USA; Das, A. P., Youngstown State Univ., USA; Sep. 1996; 86p; In English

Contract(s)/Grant(s): NAG3-1708

Report No.(s): NASA-CR-204473; NAS 1.26:204473; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A computational jet noise study of a short conical plug-nozzle (CPN) is presented. The CPN has an exit diameter of 45 mm and the geometrical configuration closely approximates that of an ideal contoured plug-nozzle having shockless flow at pressure ratio xi(sub d) = 3.62. The gasdynamics of the jet flows have been predicted using the CFD code, NPARC with k-epsilon turbulence model; these data are then used for noise computations based on the modified GE/MGB code. The study covers a range of pressure ratio, 2.0 less than or equal to xi less than or equal to 5.0. The agreement of the computational results with the available experimental data is favorable. The results indicate consistent noise reduction effectiveness of the CPN as compared to equivalent convergent, convergent-divergent and ideal contoured plug nozzles at all pressure ratios. At design pressure ratio, codes predict noise levels within 4.0 dB of the measure-

ments; and at off-design pressure ratios, in general, within 5.0 dB except at very high frequencies when deviations up to 10 dB are noted. The shock formation mechanism in the CPN jet is noted to be basically different from those in the convergent and CD nozzle jets. Author

Plug Nozzles; Supersonic Nozzles; Aeroacoustics; Aerodynamic Noise; Jet Aircraft Noise; Conical Nozzles; Pressure Ratio; Noise Reduction

Subject Term Index

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